भारतीय मानक
Indian Standard

IS 9282 : 2021

निलंबन वाले पुलों के लिए तार के रस्से और लड़ें — विशिष्टि

(दूसरा पुनरीक्षण)

Wire Ropes and Strands for Suspension Bridges — Specification

(Second Revision)

ICS 77.140.65, 93.040

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भारतीय मानक ब्यूरो
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Wire Ropes and Wire Products Sectional Committee, MED 10

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Wire Ropes and Wire Products Sectional Committee had been approved by the Mechanical Engineering Division Council.

This standard was first published in 1979 and revised in 2002. This standard is being revised again to incorporate the amendments issued and suggestions received from time to time.

In this second revision, based on the experience gained in the industry, construction details, Approximate Mass, Minimum Breaking Force have been updated and tensile test has been modified.

The composition of the Committee responsible for the formulation of this standard is given in Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard

Indian Standard

WIRE ROPES AND STRANDS FOR SUSPENSION BRIDGES — SPECIFICATION

(Second Revision)

1 SCOPE

This standard covers requirements for wire ropes and strands for use in suspension bridges for pedestrian, vehicular traffic, pipe crossing and other applications. The following types, constructions, rope/strand grades and size ranges are covered (identified by X mark).

Type	Construction		Rope/Strand Grade		Core	Size Range (mm)	Table No
			1 420	1 570			
Round Strand	a)	7 × 7 (6-1)	X	X	Steel	12-32	1
	b)	7 × 19 M (12/6-1)	X	X	Steel	23-48	2
	c)	7 × 37 M (18/12/6-1)	X	X	Steel	38-64	3
Spiral Strand	a)	1 × 7 (6-1)	X	X	Steel	6-15	4
	b)	1 × 19 J (12:6-1)	X	X	Steel	12-25	5
	c)	1 × 37 J (18:12:6-1)	X	X	Steel	20-35	6
	d)	1 × 61 J (24:18:12:6-1)	–	X	Steel	26-45	7
	e)	1 × 91 J (30:24:18:12:6-1)	–	X	Steel	33-56	8
	f)	1 × 91 J (30:24:18:12-6F-6-1)	–	X	Steel	33-56	8
	g)	1 × 127 J (36:30:24:18:12:6-1)	–	X	Steel	40-65	9
	h)	1 × 169 J (42:36:30:24:18:12:6-1)	–	X	Steel	40-65	10
Half and Full Locked Coil Wire Rope			1 370		–	26-80	11
			1 470		–	26-80	11

2 REFERENCES

The following Indian Standards contain provisions, which through reference in this text constitute the provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No	*Title*
1608 (Part 1) : 2018	Metallic materials — Tensile testing: Part 1 Method of test at room temperature (*fourth revision*)
1835 : 1976	Round steel wire for ropes (*third revision*)
2363 : 1981	Glossary of terms relating to wire ropes (*first revision*)
6594 : 2018	Technical supply conditions for steel wire ropes (*third revision*)

3 TERMINOLOGY

For the purpose of this standard, the terms and definitions given in IS 2363 shall apply.

4 MATERIAL

4.1 All the wires used in the manufacture of ropes and strands shall comply with the requirements laid down in IS 1835. In case of locked coil wire ropes, the shaped wires shall conform to the requirements of dimension and tensile test only.

4.2 Requirements of Wire

4.2.1 *Dimensional Limits and Tolerances*

The wire size tolerance shall be in accordance with IS 1835 as applicable for galvanized wire 'Type A'. The dimensions of shaped wires in case of locked coil wire ropes shall be provided at the discretion of the manufacturer.

4.2.2 *Tensile Test*

For stranded rope and spiral strand the tensile designation of individual wires shall be chosen as recommended in IS 6594. In case of locked coil wire ropes, use of wires of different tensile designations is permitted provided the Minimum Breaking Force as per Table 11 is achieved. The Manufacturer shall provide the tensile designation of all wires used in the locked coil wire ropes, if required by the purchaser.

NOTE — In general the shaped wires may be of lower tensile designation whereas the round wires may be of higher tensile designation.

4.2.3 The tensile strength shall be checked in accordance with IS 1608 (Part 1) and shall meet the requirement of IS 1835.

4.3 Elongation Test

The wire shall have an elongation not less than 4 percent of a gauge length equivalent to '100 × diameter of wire' or 200 mm whichever is lesser.

4.4 Proof Stress

When subjected to 0.2 percent proof stress test the wire shall show a force equivalent to at least 70 percent of the breaking force of the wire.

4.5 Galvanizing

4.5.1 All wires shall be galvanized. The galvanizing shall be carried out either by the hot dip or electrical process to provide a continuous, uniform coating of zinc of purity not less than 98 percent. The zinc coating shall be of 'Type A' according to IS 1835 for round wires, for shaped wires the mass of zinc coating shall not be less than 45 g/m^2.

4.5.2 *Wrap Test*

The wire shall not show any fracture when wrapped at a rate not exceeding 15 turns per minute in a close helix for at least 2 turns around a cylindrical mandrel 4 times in diameter of the wire to be tested for wires of tensile strength 1570 N/mm^2 and 3 times the diameter of the wire to be tested in case of lower tensile strength.

5 GENERAL REQUIREMENTS

General requirements shall be according to IS 6594.

6 JOINTS

6.1 In case of stranded and locked coil ropes, joint in wires shall be avoided as far as possible except where they are necessitated by the length of the rope. The joints in the wires of the strand shall be distributed as widely as possible and in no case shall more than one wire be joined in any length of 10 m of strand in case of a stranded rope and 10 m of rope length in case of locked coil wire ropes.

6.2 Joints shall be either brazed or electrically welded. If joints are brazed they shall be properly scarfed or if welded properly annealed. Tucked joints shall not be used.

7 DIRECTION OF LAY

7.1 Unless otherwise stated, the locked coil wire ropes and spiral strands shall be of right hand lay (z), and round strand wire ropes shall be of right hand ordinary lay (*sZ*).

7.2 Stranded ropes shall be of ordinary lay (*sZ* or *zS*).

7.3 Spiral strands and locked coil ropes shall be so constructed that the wires in successive layers are alternatively laid. However, in case of locked coil wire ropes, the outer layers may be laid in one direction and all the inner layers in the opposite direction.

8 LENGTH OF LAY

8.1 The length of lay for stranded ropes shall not exceed 8 times the nominal diameter of the rope.

8.2 The length of lay for spiral strands shall not exceed 15 times the nominal diameter of the strand.

8.3 The length of lay for locked coil wire ropes shall not exceed 15 times the nominal diameter of the locked coil wire rope.

9 LUBRICATION

The wire ropes/strands and the locked coil wire ropes shall be lubricated or not lubricated as per the requirement of the purchaser.

10 MINIMUM BREAKING FORCE

The minimum breaking force of wire ropes shall be as given in Tables 1 to 11.

11 ELONGATION OR STRETCH OF WIRE ROPE

In case of pre-stretched wire ropes, Annex A given for guidance, may be referred.

12 MARKING

12.1 The size, construction, rope grade, lay, core coating and length of wire rope, reel coil number along with the order number of purchaser and any other marking which may be specified by the purchaser shall be legibly mentioned on a suitable tag securely attached, when wire ropes are supplied in coils. In case wire ropes are supplied in reels, the information may be stenciled on both sides of the reels or stenciled on one side of the reel and a suitable tag giving the same information may be attached on the other side of the reel.

12.2 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act,* 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

13 PACKING

The rope shall be suitably protected to avoid damage in transit and corrosion Ropes of ordinary lay may be supplied in coils or reels as required by the purchaser.

NOTE — Lang's lay ropes and multi strand rotation resistant ropes should preferably be supplied on reels unless specified otherwise.

Table 1 Round Strand 7 × 7 (6-1) Construction Wire Rope

(*Clause* 1 *and* 10)

Nominal Diameter (mm) +4 Percent −1 Percent	Approximate Mass Kg/100m	Minimum Breaking Force Corresponding to the Rope Grade of	
		1420	1570
(1)	(2)	(3)	(4)
		KN	KN
12	58.2	73	81
13	68.3	86	95
14	79.2	100	110
15	91.9	115	127
16	103	130	144
17	117	147	163
18	131	165	183
19	146	184	203
20	162	204	225
21	178	225	248
22	196	247	273
23	214	270	298
24	233	293	324
25	253	318	352
26	273	344	381
27	295	371	411
28	317	399	442
29	340	428	474
30	364	459	507
31	388	490	541
32	414	522	577

NOTES

1 To calculate the aggregate breaking force multiply the values given in columns 3 and 4 by 1.194.

2 The values tor masses are for guidance only.

Table 2 Round Strand 7 × 19 M (12/6-1) Construction Wire Rope

(*Clause* 1 *and* 10)

Nominal Diameter (mm) +4 Percent −1 Percent	Approximate Mass Kg/100m	Minimum Breaking Force Corresponding to the Rope Grade of	
		1420	1570
(1)	(2)	(3)	(4)
		KN	KN
23	209	249	276
24	228	271	300
25	247	295	326
26	267	319	352
27	288	344	380
28	310	369	409
29	332	396	438
30	356	424	469
31	380	453	501
32	404	483	534
33	430	513	567
34	457	545	602
35	484	577	638
36	512	611	675
37	541	645	713
38	570	681	752
39	601	717	793
40	632	754	834
41	664	792	876
42	697	831	919
43	730	871	963
44	765	912	1 009
45	800	954	1 055
46	836	997	1 103
47	873	1 041	1 151
48	910	1 086	1 201

NOTES

1 To calculate the aggregate breaking force multiply the values given in columns 3 and 4 by 1.25.

2 The values tor masses are for guidance only.

Table 3 Round Strand 7 × 37 M (/18/12/6-1) Construction Wire Rope

(*Clause* 1 *and* 10)

Nominal Diameter (mm) +4 Percent −1 Percent	Approximate Mass Kg/100 m	Minimum Breaking Force Corresponding to the Rope Grade of	
		1 420	1 570
(1)	(2)	(3)	(4)
		KN	KN
38	570	653	722
39	601	688	760
40	632	723	800
41	664	760	840
42	697	798	882
43	730	836	924
44	765	875	968
45	800	916	1 012
46	836	957	1 058
47	873	999	1 104
48	910	1 042	1 152
49	948	1 086	1 200
50	988	1 130	1 250
51	1 027	1 176	1 300
52	1 068	1 223	1 352
53	1 110	1 270	1 404
54	1 152	1 318	1 458
55	1 195	1 368	1 512
56	1 239	1 418	1 568
57	1 283	1 469	1 624
58	1 329	1 521	1 682
59	1 375	1 574	1 740
60	1 422	1 628	1 800
61	1 470	1 682	1860
62	1 518	1 738	1 922
63	1 568	1 794	1 984
64	1 618	1 852	2 048

NOTES

1 To calculate the aggregate breaking force multiply the values given in columns 3 and 4 by 1.302.

2 The values for masses are for guidance only.

Table 4 Spiral Strand 1 × 7 (6-1) Construction Wire Rope

(*Clause* 1 *and* 10)

Nominal Diameter (mm) +4 Percent −1 Percent	Approximate Mass Kg/100 m	Minimum Breaking Force Corresponding to the Rope Grade of	
		1 420	1570
(1)	(2)	(3)	(4)
		KN	KN
6	18.4	28	31
7	25.0	38	42
8	32.6	49	55
9	41.3	63	69
10	51.0	77	85
11	61.7	94	103
12	73.4	111	123
13	86.2	131	144
14	100	151	167
15	115	174	192

NOTES

1 To calculate the aggregate breaking force multiply the values given in columns 3 and 4 by 1.111.

2 The values for masses are for guidance only.

Table 5 Spiral Strand 1 × 19 J (12 : 6-1) Construction

(*Clause* 1 *and* 10)

Nominal Diameter (mm) +4 Percent −1 Percent	Approximate Mass Kg/100 m	Minimum Breaking Force Corresponding to the Strand Grade of	
		1 420	1 570
(1)	(2)	(3)	(4)
		KN	KN
12	73.2	107	119
13	85.9	126	139
14	99.6	146	162
15	114	168	186
16	130	191	211
17	147	216	238
18	165	242	267
19	183	269	298
20	203	298	330
21	224	329	364
22	246	361	399
23	269	395	436
24	293	430	475
25	318	466	515

NOTES

1 To calculate the aggregate breaking force multiply the values given in columns 3 and 4 by 1.136.

2 The values for masses are for guidance only.

Table 6 Spiral Strand 1 × 37 J (18 : 12 : 6-1) Construction

(*Clause* 1 *and* 10)

Nominal Diameter (mm) +4 Percent −1 Percent	Approximate Mass Kg/100 m	Minimum Breaking Force Corresponding to the Strand Grade of	
		1 420	1570
(1)	(2)	(3)	(4)
		KN	KN
20	203	294	326
21	224	325	359
22	246	356	394
23	269	389	431
24	293	424	469
25	318	460	509
26	343	498	550
27	370	537	593
28	398	577	638
29	427	619	684
30	457	663	732
31	488	707	782
32	520	754	833
33	553	802	886
34	587	851	941
35	622	902	997

NOTES

1 To calculate the aggregate breaking force multiply the values given in columns 3 and 4 by 1.136.

2 The values for masses are for guidance only.

Table 7 Spiral Strand 1 × 61 J (24 : 18 : 12 : 6-1) Construction

(*Clause* 1 *and* 10)

Nominal Diameter (mm) +4 Percent −1 Percent	Approximate Mass Kg/100 m	Minimum Breaking Force Corresponding to the Strand Grade of 1570
(1)	(2)	(3)
		KN
26	342	544
27	369	586
28	397	630
29	426	676
30	455	724
31	486	773
32	518	823
33	551	876

Table 7 (*Concluded*)

Nominal Diameter (mm) +4 Percent −1 Percent (1)	Approximate Mass Kg/100 m (2)	Minimum Breaking Force Corresponding to the Strand Grade of 1570 (3)
34	585	929
35	620	985
36	656	1 042
37	693	1 101
38	731	1 161
39	770	1 223
40	810	1 286
41	851	1 352
42	893	1 418
43	936	1 487
44	980	1 557
45	1 025	1 628

NOTES

1 To calculate the aggregate breaking force multiply the values given in columns 3 and 4 by 1.136.

2 The values for masses are for guidance only.

Table 8 Spiral Strand 1 × 91 J (30 : 24 : 18 : 12 : 6-1) (30 : 24 : 18 : 12-6F-6-1) Construction

(*Clause* 1 *and* 10)

Nominal Diameter (mm) +4 Percent −1 Percent (1)	Approximate Mass Kg/100 m (2)	Minimum Breaking Force Corresponding to the Strand Grade of 1570 (3)
		KN
33	551	873
34	585	927
35	620	982
36	656	1 039
37	693	1 098
38	731	1 158
39	770	1 220
40	810	1 283
41	851	1 348
42	893	1 415
43	936	1 483
44	980	1 553
45	1 025	1 624
46	1 071	1 697
47	1 118	1 772
48	1 166	1 848
49	1 215	1 925
50	1 265	2 005
51	1 316	2 086
52	1 368	2 168
53	1 421	2 253
54	1 475	2 339
55	1 531	2 426
56	1 547	2 515

NOTES

1 To calculate the aggregate breaking force multiply the values given in columns 3 and 4 by 1.136.

2 The values for masses are for guidance only.

Table 9 Spiral Strand 1 × 127 J (36 : 30 : 24 : 18 : 12 : 6-1) Construction

(*Clause* 1 *and* 10)

Nominal Diameter (mm) +4 Percent −1 Percent (1)	Approximate Mass Kg/100 m (2)	Minimum Breaking Force Corresponding to the Rope Grade of 1570 (3)
		KN
40	810	1 283
41	851	1 348
42	893	1 415
43	936	1 483
44	980	1 553
45	1 025	1 624
46	1 071	1 697
47	1 118	1 772
48	1 166	1 848
49	1 215	1 925
50	1 265	2 005
51	1 316	2 086
52	1 368	2 168
53	1 421	2 253
54	1 475	2 339
55	1 531	2 426
56	1 587	2 515
57	1 644	2 606
58	1 702	2 698
59	1 761	2 792
60	1 822	2 887
61	1 883	2 984
62	1 945	3 083
63	2 008	3 183
64	2 073	3 285
65	2 138	3 388

NOTES

1 To calculate the aggregate breaking force multiply the values given in columns 3 by 1.136.

2 The values for masses are for guidance only.

Table 10 Spiral Strand 1 × 169 J (42 : 36 : 30 : 24 : 18 : 12 : 6-1) Construction

(*Clause* 1 *and* 10)

Nominal Diameter (mm) +4 Percent −1 Percent	Approximate Mass Kg/100 m	Minimum Breaking Force Corresponding to the Rope Grade of 1570
(1)	(2)	(3)
		KN
40	810	1 283
41	851	1 348
42	893	1 415
43	936	1 483
44	980	1 553
45	1 025	1 624
46	1 071	1 697
47	1 118	1 772
48	1 166	1 848
49	1 215	1 925
50	1 265	2 005
51	1 316	2 086
52	1 368	2 168
53	1 421	2 253
54	1 475	2 339
55	1 531	2 426
56	1 587	2 515
57	1 644	2 606
58	1 702	2 698
59	1 761	2 792
60	1 822	2 887
61	1 883	2 984
62	1 945	3 083
63	2 008	3 183
64	2 073	3 285
65	2 138	3 388

NOTES

1 To calculate the aggregate breaking force multiply the values given in columns 3 by 1.136.

2 The values for masses are for guidance only.

Table 11 Half and Full Locked Coil Wire Rope

(*Clause* 1 *and* 10)

Nominal rope Dia. = d , Mass factor (k) = 0.5625
Rope mass (kg/100 m) = Kd^2

Breaking force factor (K') = 0.5594 Rope grade (Tensile) = R$_o$ (i.e 1370 or 1470)

Minimum braking force of rope = (K' R$_o$ d^2)/1000 KN

Nominal diameter (mm) +4 Percent −1 Percent	Approximate (d) Mass (kg/100 m)	Minimum Breaking Force of the Locked Coil Wire Rope Corresponding to the Rope Grade of	
		1370	1470
(1)	(2)	(3)	(4)
		KN	KN
26	397	518	556
28	461	601	645
30	529	690	740
32	602	785	842
34	680	886	951
36	762	993	1 066
38	849	1 107	1 187
40	941	1 226	1 316
42	1 037	1 352	1 451
43	1 087	1 417	1 520
44	1 138	1 484	1 592
46	1 244	1 622	1 740
48	1 355	1 766	1 895
50	1 470	1 916	2 056
51	1 529	1 993	2 139
52	1 590	2 072	2 224
53	1 652	2 153	2 310
54	1 715	2 235	2 398
56	1 844	2 403	2 579
58	1 978	2 578	2 766
60	2 117	2 759	2 960
62	2 260	2 946	3 161
64	2 408	3 139	3 368
66	2 561	3 338	3 582
68	2 719	3 544	3 802
70	2 881	3 755	4 029
72	3 048	3 973	4 263
74	3 220	4 197	4 503
76	3 396	4 427	4 750
78	3 577	4 663	5 003
80	3 763	4 905	5 263

NOTES

1 To calculate the aggregate breaking force multiply the values given in columns 3 and 4 by 1.09.

2 The values for masses are for guidance only.

ANNEX A

(*Clause* 11)

ELONGATION OR STRETCH OF WIRE ROPE/STRAND

A-1 STRECHES IN WIRE ROPE STRANDS

There are two kinds of stretches in a wire rope/strand.

A-1.1 Permanent Constructional Stretch

This is caused by the lengthening of the rope/strand lay and the reduction in rope/strand diameter. The extent of this stretch depends upon the rope/strand construction, the length of lay, the type of core and some other factors. For stranded operating ropes, this stretch varies from 0.25 percent to 1.0 percent depending upon the operating loads. For locked coil wire ropes and spiral strands the comparable figure of permanent constructional stretch would be from 0.15 percent to 0.5 percent

A-1.2 Elastic Stretch

This is caused by the action of tensile stress on the metallic area of the rope/strand conforming to their elastic property. The amount of elastic stretch may be determined by the formula given below:

$$l_e = \frac{P \times L}{A \times E}$$

where

l_e = elastic stretch of rope/strand, in cm;
P = load or tension on rope/strand, in N;
L = initial length of rope/strand under stress, in cm;
A = metallic area of rope/strand, in cm^2; and
E = modulus of elasticity of rope/strand, in N/cm^2 based on its metallic area.

A-2 MODULUS OF ELASTICITY

Commonly used approximate value of modulus of elasticity for various constructions of wire ropes/strands covered under this specification are given in Table 12 new or unused ropes/strands invariably have a total elongation under load greater than used rope/strands of the same specification, since the larger pan of the stretch occurs during the initial period of its useful life. Subsequently, the modulus of elasticity would also be smallest for a wire rope/strand during this period Modulus of elasticity for old and used rope/strand is approximately 20 percent in excess of values shown in Table 12.

It is for this reason that pre-stretched ropes/strands are preferred for construction of bridges. Pre-stretching is the process of cyclic loading of the rope/strand to 5 to 50 percent of the minimum breaking strength till the stretch in the rope/strand at any given load between 5 percent and 50 percent stabilizes. Table 12 indicates the comparative values prior to pre-stretching and after pre-stretching.

Table 12 Modulus of Elasticity of Rope/Strand

(*Clause* A-2)

Sl No.	Type of Wire Rope/Strand	Construction	Modulus of Elasticity in N/cm^2	
			As Manufactured	Pre-stretched
1	Stranded rope	7 × 7	69×10^6	86×10^6
		7 × 19 M	65×10^6	81×10^6
		7 × 37 M	61×10^6	76×10^6
2	Spiral strand	1 × 7	110×10^6	131×10^6
		1 × 19 J	100×10^6	128×10^6
		1 × 37 J	95×10^6	128×10^6
		1 × 61 J	93×10^6	120×10^6
		1 × 91 J	90×10^6	117×10^6
		1 × 127 J	87×10^6	113×10^6
3	Full locked and half locked toil wire rope		103×10^6	131×10^6

ANNEX B

(*Foreword*)

COMMITTEE COMPOSITION

Wire Ropes and Wire Products Sectional Committee, MED 10

Organization	*Representative(s)*
Directorate General of Mines Safety, Dhanbad	Shri D. B. Naik (***Chairman***) Shri M. Arumugam (*Alternate*)
Asahi Ropes, New Delhi	Shri Nakul Gupta Shri Mikesh Gupta (*Alternate*)
Bharat Coking Coal Limited, Dhanbad	Shri P. K. Sinha
Bharat Wire Ropes Limited, Mumbai	Shri Amol Mokhadkar
CSIR-Central Institute for Mining and Fuel Research, Dhanbad	Dr Manoj Kumar Singh Shri Desbasish Basak (*Alternate*)
Directorate General Factory Advice Service and Labour Institutes, Mumbai	Shri Amit Gola B. N. Jha (*Alternate*)
Directorate General Quality Assurance, New Delhi	Col Manjunath B. T.
Directorate General of Aeronautical Quality Assurance, New Delhi	Shri Santosh Namdeo
Directorate General of Civil Aviation, New Delhi	Shri Hillol Biswas Shri Lalit Gupta (*Alternate*)
Eastern Coalfields Limited, Dishergarh	Dr Manas Kumar
KIS WIRE ROPE	Shri Subho Ghosh Shri Ajit Vikram Singh (*Alternate*)
Maccaferri Environmental Solutions Private Limited, Gurugram	Ms Minimol Korulla Shri Rudra Budhbhatti (*Alternate*)
Manganese Ore Limited, Nagpur	Shri Atul Sharma Shri Ashwini Baghele (*Alternate* I) Shri S. C. Rai (*Alternate* II)
Ministry of Shipping, New Delhi	Shri Anil Pruthi Shri Ramji Singh (*Alternate*)
National Test House, Kolkata	Shri Suresh Parwal Shri Angad Verma (*Alternate*)
Oil and Natural Gas Corporation Limited, New Delhi	Shri Sunil Kumar Tewari
Orient Wire Ropes, Indore	Dr Sameer Golwelkar
South Eastern Coalfields Limited, Bilaspur	Shri Kapil K. Rai Shri D. Bhattacharjee (*Alternate*)
Tata Steel Limited, Dhanbad	Shri Abinash Jha
The Singareni Collieries Company Limited, Kothagudem	Shri A. Govinda Rao

Organization	*Representative(s)*
Usha Martin Limited, Ranchi	Shri Subrata Dutta Shri Sandeep Jaiswal (*Alternate*)
BIS Directorate General	Shri Rajneesh Khosla Scientist ‘E’ Head (MED) [Representing Director General (*Ex-officio*)]

Member Secretary

Shri Sandeep Keshav
Scientist ‘C’ (MED), BIS

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